Docket No. 10030926-1 *PATENT*

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of: **Annette C. Grot et al.**	§	Group Art Unit: **2872**
Serial No. **10/791,449**	§	Examiner: **Chang, Audrey Y.**
Filed: **March 2, 2004**	§	
For: **Imaging System with Large Depth of Field**	§	

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

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By: Michele Morrow
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APPEAL BRIEF (37 C.F.R. 41.37)

This brief is in furtherance of the Notice of Appeal, filed in this case on January 3, 2006.

A fee of $500.00 is required for filing an Appeal Brief. Please charge this fee to Agilent Technologies Deposit Account No. 50-1078. No additional fees are believed to be necessary. If, however, any additional fees are required, I authorize the Commissioner to charge these fees which may be required Agilent Technologies Deposit Account No. 50-1078.

A one-month extension of time is believed to be necessary. I authorize the Commissioner to charge the one-month extension fee of $120.00 to Yee & Associates, P.C. Deposit Account No. 50-3157. No additional extension of time is believed to be necessary. If, however, an additional extension of time is required, the extension is requested, and I authorize the Commissioner to charge any fees for this extension to Yee & Associates, P.C. Deposit Account No. 50-3157.

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REAL PARTY IN INTEREST

The real party in interest in this appeal is the following party: Agilent Technologies, Inc.

RELATED APPEALS AND INTERFERENCES

With respect to other appeals or interferences that will directly affect, or be directly affected by, or have a bearing on the Board's decision in the pending appeal, there are no such appeals or interferences.

STATUS OF CLAIMS

A. TOTAL NUMBER OF CLAIMS IN APPLICATION

Claims in the application are: 1-22

B. STATUS OF ALL THE CLAIMS IN APPLICATION

1. Claims canceled: 9
2. Claims withdrawn from consideration but not canceled: NONE
3. Claims pending: 1-8 and 10-22
4. Claims allowed: NONE
5. Claims rejected: 1-8 and 10-22
6. Claims objected to: NONE

C. CLAIMS ON APPEAL

The claims on appeal are: 1-8 and 10-22

STATUS OF AMENDMENTS

An Amendment after Final Rejection was filed on December 5, 2005. An Advisory Action dated December 20, 2005, indicated that the proposed amendments would not be entered. Accordingly, the claims on appeal herein are as submitted in the Amendment filed July 21, 2005, and finally rejected in the Final Office Action dated October 3, 2005.

SUMMARY OF CLAIMED SUBJECT MATTER

The subject matter the claims is directed to an imaging system and to a method for providing a desired image of an object. The imaging system is illustrated in **Figure 1** and includes imaging optics **14** for forming an image of an object **20** (see page 3, lines 14-15) at an unknown object distance within an object distance range, and having a focal length that varies with wavelength of light that illuminates the object **20** (see page 3, lines 22-23). An image receiving unit **16** receives an image of the object **20** formed by the imaging optics **14** (see page 3, lines 15-16), and a light source **18** sequentially illuminates the object **20** with light of different ones of a plurality of wavelengths for providing a plurality of images of the object **20** received by the image receiving unit **16** (see page 5, lines 9-14 and page 7, line 24-page 8, line 1). A processor **32** selects a desired image among the plurality of received images (see page 7, lines 6-17). The desired image may be a best-focused image among the plurality of received images (see page 7, lines 11-13 and page 8, lines 5-7).

The method is illustrated in **Figure 2** and includes sequentially illuminating an object at an unknown object distance within an object distance range with light of different ones of a plurality of wavelengths, and forming a plurality of images of the object with an imaging system having a focal length that varies with a wavelength of the light that illuminates the object (Step **44** in **Figure 2**, see also page 7, line 24-page 8, line 1). A desired image among the plurality of formed images is selected (Step **46** in **Figure 2**, see also page 8, lines 5-7).

GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL

A. GROUND OF REJECTION 1

Claims 1-8 and 10-22 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement.

B. GROUND OF REJECTION 2

Claims 1-8 and 10-22 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hinnrichs (US Patent No. 5,867,264) in view of Shipp et al. (US Patent No. 5,264,925)

ARGUMENT

A. GROUND OF REJECTION 1 (Claims 1-8 and 10-22)

Claims 1-8 and 10-22 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement.

In rejecting the claims, the Examiner states:

> The claim(s) contain subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention.

Final Office Action dated October 3, 2005, page 2.

The Examiner further states:

> The added material which is not supported by the original disclosure is as follows: claims 1 and 15 have been amended to include the phrase "an object at an unknown object distance within an object distance range". The specification fails to give explicit support for such feature.

Final Office Action dated October 3, 2005, page 2.

Appellants respectfully disagree that claims 1-8 and 10-22 fail to comply with the written description requirement. 35 U.S.C. 112, first paragraph, states:

> The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same, and shall set forth the best mode contemplated by the inventor of carrying out his invention.

Appellants submit that the specification of the present application contains a written description that fully, clearly, concisely and exactly describes the invention claimed in claims 1-8 and 10-22 on appeal herein such that any person skilled in the art is fully enabled to make and use the invention. More specifically, Appellants submit that the phrase "an object at an unknown object distance within an object distance range" in claims 1 and 15 is fully supported by the original disclosure.

The present invention is directed to a mechanism for providing a well-focused image of an object wherein the distance between an imaging lens and the object may vary. For

example, as recited on page 6, lines 6-10 of the specification:

> As shown in FIGURE 1, image receiving unit 16 and object 20 are positioned on optical axis 22 of imaging lens 14. The distance between imaging lens 14 and image receiving unit 16 is assumed to be fixed; however, the distance between imaging lens 14 and object 20 (the object distance) may vary. It is assumed, however, that the object remains substantially stationary during a particular imaging operation.

Further, on page 6, lines 11-17, an imaging operation is described as follows:

> In an imaging operation, light sources 18a-18d are turned on and off one at a time in sequence by controller 30; and image receiving unit 16 captures an image of object 20 each time the object is illuminated by one of the light sources. If the wavelength range of the light sources and the design of the imaging optics are chosen appropriately <u>for the possible variation in object distance</u>, one of the images captured by image receiving unit 16 will comprise a well-focused, high resolution image of the object. (emphasis added)

Yet further, in describing an exemplary embodiment of the invention wherein the object is the iris of a person's eye, it is stated on page 6, line 19 to page 7, line 5:

> Such an imaging application may involve a variation in object distance of from about 5 inches to about 20 inches. For such an application, light sources 18a-18d can comprise commercially available LEDS having different wavelengths in the wavelength range of from about 450nm to about 980nm. With an imaging lens having a diffractive component only, this wavelength range will produce a change of over 2x in the focal length of the lens. With a combined refractive/diffractive lens as the imaging lens, the lens will not have to change its focal length by such a large factor. For example, if the refractive surface power is designed to be suitable for forming a well-focused image of an object positioned at about the middle of <u>the anticipated object distance range</u>, the combined lens would only have to change its focal length by about 1.14x, and this can be readily achieved by choosing only a few, for example, 3-5 different LED wavelengths in the 450nm to 980nm range. (emphasis added).

Also, on page 8, lines 14-19, another exemplary embodiment of the invention is described:

> Among such other applications include applications involving triggered surveillance of a defined space. For example, an entomologist can set up an unattended imaging system to be triggered by an insect that enters a defined space along and <u>around the optical axis</u> of the imaging system, <u>but not at any specific object distance</u>. The imaging system will then capture a series of images, one of which is selected for best focus. (emphasis added)

The above recitations make it clear that the object being imaged is at an unknown object distance from the imaging optics. In fact, it is because the object is at an unknown object distance from the imaging optics that the object is illuminated with light of different wavelengths in order to obtain a well-focused image of the object. In the above described exemplary embodiment regarding triggered surveillance of an insect, it is especially clear that the insect would be at an unknown object distance, i.e., "around the optical axis of the imaging system, but not at any specific object distance".

Appellants respectfully submit that the above and other recitations in the present application as filed fully, clearly, concisely and exactly describe the invention claimed in claims 1-8 and 10-22 on appeal herein such that any person skilled in the art is fully enabled to make and use the invention. Claims 1-8 and 10-122, accordingly, are supported by the disclosure and satisfy the requirements of 35 U.S.C. 112.

It is, accordingly, respectfully requested that the Board reverse the Examiner's final rejection of the claims under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement.

B. GROUND OF REJECTION 2

Claims 1-8 and 10-22 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hinnrichs (US Patent No. 5,867,264) in view of Shipp et al. (US Patent No. 5,264,925).

B.1 Claims 1-8, 11-15 and 17-22

In finally rejecting the claims, the Examiner states:

> **Hinnrichs** teaches an *apparatus for imaging object* that is comprised of a diffractive lens (11, Figure 1) serves as the *imaging optics* for forming an image of *an object* (10, Figure 1) *at an object distance within an object distance range*, wherein the diffractive lens has a focal length that *varies* with the wavelength of the light that illuminates the object. The imaging apparatus further comprises a photodetector (12) serves as the *image-receiving unit* (5) for receiving the image of the object formed by the imaging diffractive lens. Hinnrichs teaches explicitly that a plurality of images of the object having different colors or wavelengths are formed by the diffractive lens at different focal points, wherein when the photodetector is located at *one particular focal length from the object* (such as f_r), it will receive an in-focused red image of the object and a plurality of out-focused images of the object for all other colors of light. Hinnrichs then teaches that a *processor* is used to *enhance* the in-focus image which in a way "selects" the desired in-focus among the plurality of

images received (please see Figures 1-2, column 1-3).

Final Office Action dated October 3, 2005, page 3.

Claim 1 of the present application is as follows:

1. An imaging system, comprising:
an imaging optics for forming an image of an object at an unknown object distance within an object distance range, said imaging optics having a focal length that varies with wavelength of light that illuminates the object;
an image receiving unit for receiving an image of said object formed by said imaging optics;
a light source for sequentially illuminating said object with light of different ones of a plurality of wavelengths for providing a plurality of images of said object received by said image receiving unit; and
a processor for selecting a desired image among said plurality of received images.

A fundamental notion of patent law is the concept that invention lies in the new combination of old elements. Therefore, a rule that every invention could be rejected as obvious by merely locating each element of the invention in the prior art and combining the references to formulate an obviousness rejection is inconsistent with the very nature of "invention." Consequently, a rule exists that a combination of references made to establish a *prima facie* case of obviousness must be supported by some teaching, suggestion, or incentive contained in the prior art which would have led one of ordinary skill in the art to make the claimed invention.

The Examiner bears the burden of establishing a *prima facie* case of obviousness based on the prior art when rejecting claims under 35 U.S.C. § 103. *In re Fritch*, 972 F.2d 1260, 23 U.S.P.Q.2d 1780 (Fed. Cir. 1992). The requirements for establishing a *prima facie* case of obviousness in view of a combination of references are set forth in detail in Section 2142 of the MPEP and include the requirements that the Examiner explain in detail why the combination of the teachings is proper, that the Examiner provide a clear and convincing line of reasoning as to why an artisan would have found the claimed invention obvious in light of the teachings of the references, and that the Examiner provide a showing that it is the prior art and not the Applicant's own disclosure that teaches the combination asserted by the Examiner.

Appellants respectfully submit that neither Hinnrichs nor Shipp et al. contains any teaching, suggestion, or incentive that would direct one of ordinary skill in the art to the invention recited in claim 1. In particular, neither Hinnrichs nor Shipp et al. nor their combination teaches or suggests "a light source for sequentially illuminating" an object at an unknown object distance within an object distance range "with light of different ones of a plurality of wavelengths for providing a plurality of images of said object received by said image receiving unit" or "a processor for selecting a desired image among said plurality of received images" as recited in claim 1.

Hinnrichs is directed to an imaging spectrometer for measuring the spectral composition of objects from a remote location. In Hinnrichs, image multispectral sensing (IMSS) records the light spectrum of luminous objects in order to identify the objects (target recognition). As described in col. 1, lines 32-63 of Hinnrichs, polychromatic light emanating from an object is collected by a dispersive optical element which disperses the light and focuses the dispersed light onto a photodetector. The dispersive optical element focuses light of different wavelengths at different focal lengths; and, accordingly, Hinnrichs discloses that by incrementally changing the spacing between the diffractive lens and the photodetector, focused images of the object at different wavelengths can be recorded. As described in col. 2, lines 33-36 of Hinnrichs, "The frames can be viewed as digital color separation of the image and that superimposing the frames will reconstruct the fully chromatic image".

In rejecting the claims, the Examiner acknowledges that Hinnrichs does not explicitly disclose "a light source for sequentially illuminating said object with light of different ones of a plurality of wavelengths for providing a plurality of images of said object received by said image receiving unit", but cites Shipp et al. as disclosing this feature. In particular, the Examiner states:

> **Shipp** et al in the same field of endeavor teaches a color imaging system that uses a *plurality* of light emitting diodes (LEDs, 11-13, Figure 1, three diodes are used in this demonstration) for sequentially illuminating an object to obtain different color images of the object (please see column 2, line 59 to column 3, line 9). It would have been obvious to apply the teachings of **Shipp** et al to modify the imaging apparatus of **Hinnrichs** to use a light source that is capable of illuminating the object sequentially with different color or wavelength of the light so that different color or wavelength component of the image of the object can be processed at a time.

Final Office Action dated October 3, 2005, page 4.

Appellants respectfully disagree. Initially, Appellants respectfully submit that Hinnrichs and Shipp et al. (hereinafter "Shipp") are not in the same field of endeavor, as suggested by the Examiner; and, further, that neither Hinnrichs nor Shipp is in the same field of endeavor as the present invention. Hinnrichs relates to a spectrometer system for measuring the spectral composition of an object to permit identification of the object. Shipp, on the other hand, relates to a system for forming high resolution color video signals suitable for use in viewing an object on a television screen. Shipp sequentially illuminates an object with light of different colors in order "to eliminate flicker in a simplified sequential color video system" (see col. 2, lines 5-7 of Shipp). One skilled in the art seeking to achieve the present invention would not be led to the spectrometer system of Hinnrichs, and would not be led to combine the spectrometer system of Hinnrichs with the teachings of Shipp in order to achieve the present invention.

Furthermore, Appellants respectfully submit that even with the Hinnrichs and Shipp references before him, one skilled in the art would not find it obvious "to modify the imaging apparatus of Hinnrichs to use a light source that is capable of illuminating the object sequentially with different color or wavelength of the light" as asserted by the Examiner. The system illustrated in Fig. 1 of Hinnrichs and referred to by the Examiner does not appear to include a light source of any kind and would appear to have no reason to include a light source of any kind. The purpose of the system of Hinnrichs is to measure the spectral composition of luminous objects to permit the object to be identified. To accomplish this, the system in Hinnrichs collects light that emanates from the objects. The system disclosed in Hinnrichs does not appear to require a light source to illuminate the objects, and there is certainly no teaching or suggestion in either Hinnrichs or Shipp to include a light source in the spectrometer system of Hinnrichs.

Yet further, even if there was some type of motivation to provide a light source in the system of Hinnrichs (which is not the case), providing a light source that sequentially illuminates an object with light of different ones of a plurality of wavelengths would appear to defeat the purpose of the system described in Hinnrichs which is to measure the entire spectral composition of an object to permit the object to be identified. There would certainly appear to be no motivation to include the particular light source disclosed in Shipp in the system of Hinnrichs.

For at least all the above reasons, neither Hinnrichs nor Shipp nor their combination teaches or suggests "a light source for sequentially illuminating" an object at an unknown

object distance within an object distance range "with light of different ones of a plurality of wavelengths for providing a plurality of images of said object received by said image receiving unit". Claim 1, accordingly, is not obvious over Hinnrichs in view of Shipp, and the Examiner has not fulfilled the requirements for establishing a *prima facie* case of obviousness of claim 1 over Hinnrichs in view of Shipp. Appellants respectfully submit that it is Appellants' own disclosure and not the cited art of record that teaches or suggests the combination proposed by the Examiner.

Appellants also respectfully submit that neither Hinnrichs nor Shipp nor their combination teaches or suggests "a processor for selecting a desired image among said plurality of received images" as also recited in claim 1. The Examiner states on page 3 of the Final Office Action that "Hinnrichs then teaches that a *processor* is used to *enhance* the in-focus image which in a way "selects" the desired in-focus image among the plurality of images received (please see Figures 1-2, column 1-3)". Appellants respectfully disagree. Enhancing an image is in no way the same as selecting a desired image among a plurality of received images, and is certainly not a teaching of a processor for selecting a desired image among a plurality of received images that are formed by sequentially illuminating an object with light of different ones of a plurality of wavelengths, as recited in claim 1.

Column 3, lines 29-34 of Hinnrichs is as follows:

> The signal processor **14** uses a deconvolution algorithm to enhance the in-focus image of each "frame" of data. By tracking and comparing the signal output of the individual pixels in each frame from one frame to the next, the relative position and spectral composition or "color signature" of each luminous object comprising the image is recorded.

The above recitation specifically states that the processor enhances an "in-focus" image of <u>each frame of data</u>. The recitation does not disclose or suggest that the processor selects "a desired image among said plurality of received images" as recited in claim 1. Again, only the present application contains such a disclosure.

For at least all of the above reasons, claim 1 is not obvious over Hinnrichs in view of Shipp, and should be allowable in its present form

Claims 2-8 and 10-14 depend from and further restrict claim 1, and should also be allowable in their present form, at least by virtue of their dependency,

Independent claim 15 recites limitations similar to claim 1 and should be allowable in its present form for similar reasons as discussed above with respect to claim 1. Claims 16-22

depend from and further restrict claim 15 and should also be allowable, at least by virtue of their dependency.

B.2 Claims 10 and 16

Claim 10 depends from claim 1 and specifies that the desired image is a best-focused image among the plurality of received images. In rejecting claim 10, the Examiner states:

> With regard to claims 10 and 16, Hinnrichs teaches that the best-focused image is processed to enhance the image (please see column 3, lines 29-32).

Final Office Action dated October 3, 2005, page 5.

Column 3, lines 29-34 of Hinnrichs is again reproduced for the convenience of the Board:

> The signal processor **14** uses a deconvolution algorithm to enhance the in-focus image of each "frame" of data. By tracking and comparing the signal output of the individual pixels in each frame from one frame to the next, the relative position and spectral composition or "color signature" of each luminous object comprising the image is recorded.

As discussed previously, the above recitation specifically states that the processor enhances an "in-focus" image of each frame of data. The recitation does not disclose or suggest that the processor selects a desired image among a plurality of received images as recited in claim 1, and certainly does not disclose or suggest that the desired image to be selected is "a best-focused image among the plurality of received images" as recited in claim 10. Hinnrichs does not disclose a selection process but enhances <u>each frame of data</u> as stated above.

Claim 10, accordingly, patentably distinguishes over Hinnrichs in view of Shipp in its own right as well as by virtue of its dependency.

Claim 16 depends from claim 15, and recites similar subject matter as claim 10. Claim 16, accordingly, also patentably distinguishes over the Hinnrichs in view of Shipp for similar reasons as discussed above with respect to claim 10.

For at least all the above reasons, it is respectfully requested that the Board reverse the Examiner's final rejection of claims 1-8 and 10-22 under 35 U.S.C. 103 as being unpatentable over Hinnrichs in view of Shipp.

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CLAIMS APPENDIX

The text of the claims involved in the appeal are:

1. An imaging system, comprising:

an imaging optics for forming an image of an object at an unknown distance within an object distance range, said imaging optics having a focal length that varies with wavelength of light that illuminates the object;

an image receiving unit for receiving an image of said object formed by said imaging optics;

a light source for sequentially illuminating said object with light of different ones of a plurality of wavelengths for providing a plurality of images of said object received by said image receiving unit; and

a processor for selecting a desired image among said plurality of received images.

2. The imaging system according to Claim 1, wherein said imaging optics has a focal length that varies inversely with a wavelength of light that illuminates the object.

3. The imaging system according to Claim 2, wherein said imaging optics comprises a combined refractive/diffractive lens.

4. The imaging system according to Claim 1, wherein said image receiving unit comprises an array of photosensors.

5. The imaging system according to Claim 4, wherein said array of photosensors comprises a CMOS detector array.

6. The imaging system according to Claim 1, wherein said light source comprises a plurality of separate light sources, each of said plurality of separate light sources illuminating said object with light of a different wavelength.

7. The imaging system according to Claim 6, wherein said plurality of separate light sources comprises a plurality of light emitting diodes.

8. The imaging system according to Claim 6, wherein said plurality of separate light sources comprises from about three to about five light sources.

10. The imaging system according to Claim 1, wherein said desired image comprises a best-focused image among said plurality of received images.

11. The imaging system according to Claim 2, wherein the object distance range comprises from about 5 inches to about 20 inches, and wherein said plurality of wavelengths comprise a plurality of wavelengths between about 450nm and about 980nm.

12. The imaging system according to Claim 11, wherein said object comprises an iris of an eye.

13. The imaging system according to Claim 11, wherein said object comprises a fingerprint.

14. The imaging system according to Claim 1, wherein said imaging system comprises a digital still camera.

15. A method for providing a desired image of an object, comprising:

sequentially illuminating an object at an unknown object distance within an object distance range with light of different ones of a plurality of wavelengths forming a plurality of images of said object with an imaging system having a focal length that varies with a wavelength of the light that illuminates the object; and

selecting a desired image among said plurality of formed images.

16. The method according to Claim 15, wherein said selecting comprises selecting a best-focused image among said plurality of formed images.

17. The method according to Claim 15, wherein sequentially illuminating an object at an unknown object distance within object distance range with light of different ones of a plurality of wavelengths comprises sequentially illuminating said object with light of a plurality of separate light sources, each of said plurality of separate light sources illuminating said object with light of a different wavelength.

18. The method according to Claim 15, wherein forming a plurality of images of said object with an imaging system having a focal length that varies with a wavelength of the light that illuminates the object comprises forming a plurality of images of said object with an imaging system having a focal length that varies inversely with a wavelength of the light that illuminates the object.

19. The method according to Claim 18, wherein the object distance range comprises from about 5 inches to about 20 inches, and wherein said plurality of wavelengths comprise a plurality of wavelengths between about 450nm and about 980nm.

20. The method according to Claim 15, wherein forming a plurality of images of said object with an imaging system having a focal length that varies with a wavelength of the light that illuminates the object comprises forming said plurality of images on a photosensor array.

21. The method according to Claim 15, wherein sequentially illuminating an object at an unknown object distance within an object distance range with light of different ones of a plurality of wavelengths comprises sequentially illuminating said object at a rate of 60 images per second.

22. The method according to Claim 15, wherein said imaging system comprises a digital still camera.

EVIDENCE APPENDIX

There is no evidence to be presented.

RELATED PROCEEDINGS APPENDIX

There are no related proceedings.